

Geometry 3-4 Study Guide Perpendicular Lines (pp 172-174)

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Attendance Problems. Solve each inequality.

1. $x - 5 < 8$

2. $3x + 1 > x$

Solve each equation.

3. $5y = 90$

4. $5x + 15 = 90$

5. Solve the system of equations:
$$\begin{cases} 6y = 90 \\ 8y - 3x = 90 \end{cases}$$

I can prove and apply theorems about perpendicular lines.

Common Core

CC.9-12.G.CO.9 Prove geometric theorems about lines and angles.

CC.9-12.G.CO.12 Make formal geometric constructions with a variety of tools and methods.

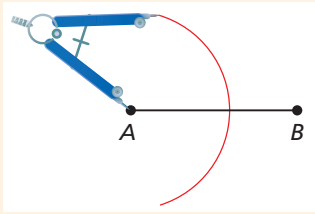
6. What is a perpendicular bisector?

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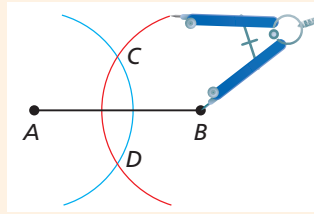
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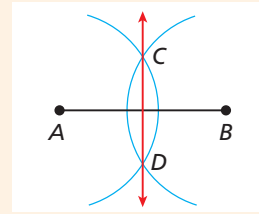
Construction Perpendicular Bisector of a Segment



- 1 Draw \overline{AB} . Open the compass wider than half of AB and draw an arc centered at A .



- 2 Using the same compass setting, draw an arc centered at B that intersects the first arc at C and D .



- 3 Draw \overleftrightarrow{CD} . \overleftrightarrow{CD} is the perpendicular bisector of \overline{AB} .



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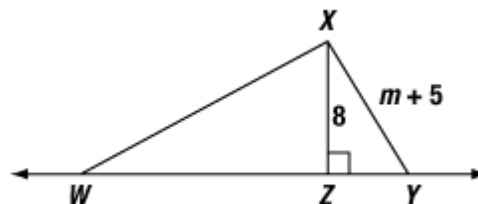
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7. How do you measure the distance from a point to a line?

Video Example 1.

A. Name the shortest segment from X to line WY.

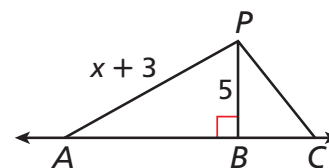
B. Write and solve an inequality for m.



1 Distance From a Point to a Line

A Name the shortest segment from P to \overleftrightarrow{AC} .

The shortest distance from a point to a line is the length of the perpendicular segment, so \overline{PB} is the shortest segment from P to \overleftrightarrow{AC} .



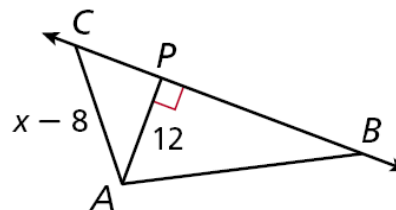
B Write and solve an inequality for x .

$$\begin{array}{rcl}
 PA > PB & \overline{PB} \text{ is the shortest segment.} \\
 x + 3 > 5 & \text{Substitute } x + 3 \text{ for } PA \text{ and } 5 \text{ for } PB. \\
 \underline{-3} \quad \underline{-3} & \text{Subtract 3 from both sides of the inequality.} \\
 x > 2 &
 \end{array}$$

Example 1

A. Name the shortest segment from point A to BC .

B. Write and solve an inequality for x .

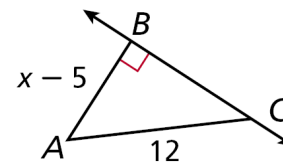


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Guided Practice.

8. Name the shortest segment from A to \overline{AC} .



9. Write and solve an inequality for x .

Theorems

THEOREM	HYPOTHESIS	CONCLUSION
3-4-1 If two intersecting lines form a linear pair of congruent angles, then the lines are perpendicular. (2 intersecting lines form lin. pair of $\cong \angle$ s \rightarrow lines \perp .)		$\ell \perp m$
3-4-2 Perpendicular Transversal Theorem In a plane, if a transversal is perpendicular to one of two parallel lines, then it is perpendicular to the other line.		$q \perp p$
3-4-3 If two coplanar lines are perpendicular to the same line, then the two lines are parallel to each other. (2 lines \perp to same line \rightarrow 2 lines \parallel .)		$r \parallel s$

Q: Why is the angle formed by two perpendicular lines never wrong?

A: Because it's always *right*!

Truth has always been found to promote the best interests of mankind... - Percy Bysshe Shelley

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PROOF

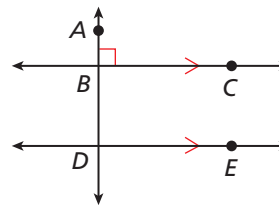
Perpendicular Transversal Theorem

Given: $\overleftrightarrow{BC} \parallel \overleftrightarrow{DE}$, $\overleftrightarrow{AB} \perp \overleftrightarrow{BC}$

Prove: $\overleftrightarrow{AB} \perp \overleftrightarrow{DE}$

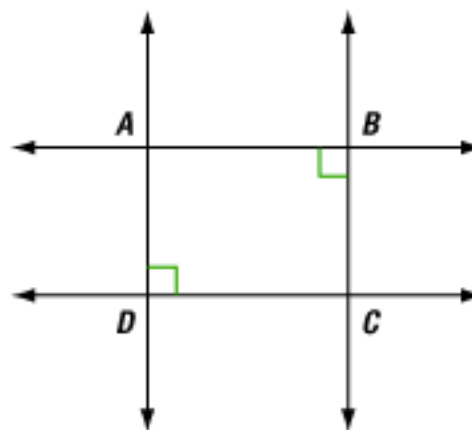
Proof:

It is given that $\overleftrightarrow{BC} \parallel \overleftrightarrow{DE}$, so $\angle ABC \cong \angle BDE$ by the Corresponding Angles Postulate. It is also given that $\overleftrightarrow{AB} \perp \overleftrightarrow{BC}$, so $m\angle ABC = 90^\circ$. By the definition of congruent angles, $m\angle ABC = m\angle BDE$, so $m\angle BDE = 90^\circ$ by the Transitive Property of Equality. By the definition of perpendicular lines, $\overleftrightarrow{AB} \perp \overleftrightarrow{DE}$.



Video Example 2. Given: Line AB \parallel line DC, Line AB is perpendicular to line CB. Line AD is perpendicular to line DC.

Prove: Line AB \parallel line BC.



2

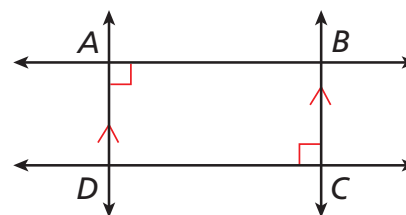
Proving Properties of Lines

Write a two-column proof.

Given: $\overleftrightarrow{AD} \parallel \overleftrightarrow{BC}$, $\overleftrightarrow{AD} \perp \overleftrightarrow{AB}$, $\overleftrightarrow{BC} \perp \overleftrightarrow{DC}$

Prove: $\overleftrightarrow{AB} \parallel \overleftrightarrow{DC}$

Proof:



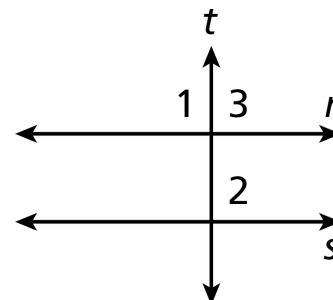
Statements	Reasons
1. $\overleftrightarrow{AD} \parallel \overleftrightarrow{BC}$, $\overleftrightarrow{BC} \perp \overleftrightarrow{DC}$	1. Given
2. $\overleftrightarrow{AD} \perp \overleftrightarrow{DC}$	2. \perp Transv. Thm.
3. $\overleftrightarrow{AD} \perp \overleftrightarrow{AB}$	3. Given
4. $\overleftrightarrow{AB} \parallel \overleftrightarrow{DC}$	4. 2 lines \perp to same line \rightarrow 2 lines \parallel .

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Example 2. Given: $r \parallel s$, $\angle 1$ is congruent to $\angle 2$.

Prove: r is perpendicular to t .

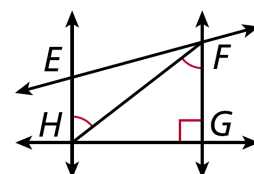


10. Guided Practice. Write a two-column proof.

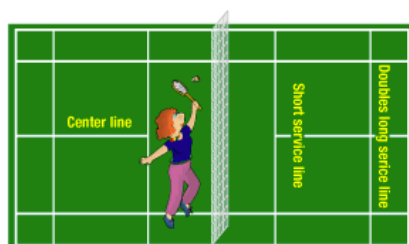
Given: $\angle EHF \cong \angle HFG$

$\overline{FG} \perp \overline{GH}$

Prove: $\overline{EH} \perp \overline{GH}$



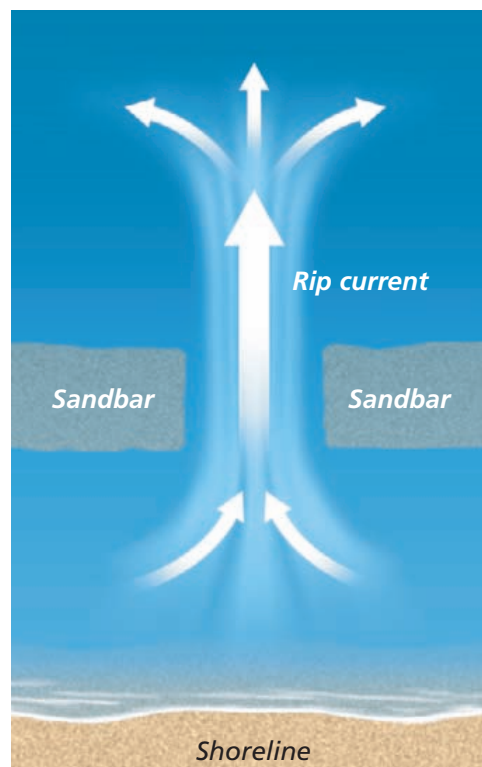
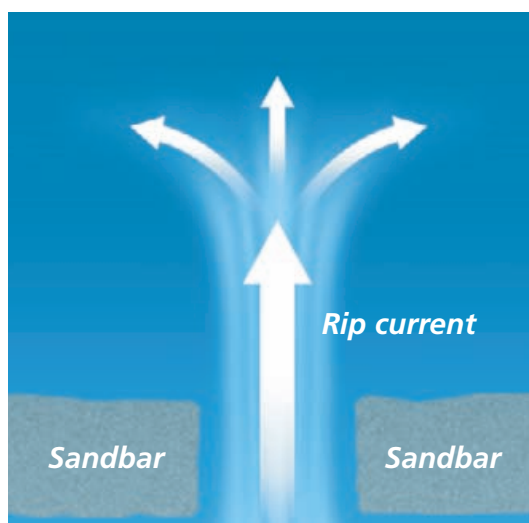
Video Example 3. The center line of a badminton court is perpendicular to the short service line and the double long service line. Explain why the service lines must be parallel to each other.



3 Oceanography Application

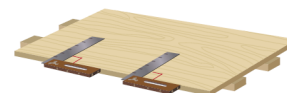
Rip currents may be caused by a sandbar parallel to the shoreline. Waves cause a buildup of water between the sandbar and the shoreline. When this water breaks through the sandbar, it flows out in a direction perpendicular to the sandbar. Why must the rip current be perpendicular to the shoreline?

The rip current forms a transversal to the shoreline and the sandbar.



The shoreline and the sandbar are parallel, and the rip current is perpendicular to the sandbar. So by the Perpendicular Transversal Theorem, the rip current is perpendicular to the shoreline.

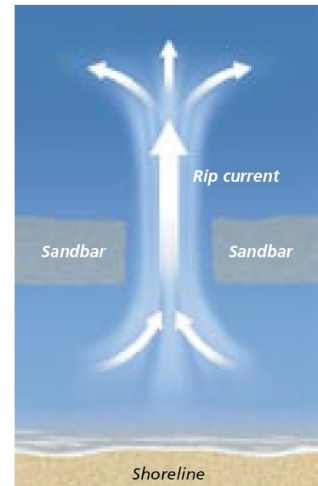
Example 3. A carpenter's square forms a right angle. A carpenter places the square so that one side is parallel to an edge of a board, and then draws a line along the other side of the square. Then he slides the square to the right and draws a second line. Why must the two lines be parallel?



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11. Guided Practice. A swimmer who gets caught in a rip current should swim in a direction perpendicular to the current. Why should the path of the swimmer be parallel to the shoreline?



3-4 Perpendicular Lines

- (pp 175) 6-10, 12, 22, 23, 26, 28, 36.
- 3A Ready to Go On & posttests.

